

### **Amendments to the Specification:**

*Please amend the paragraph (section) beginning on page 1, at line 5 as shown below:*

The present invention relates to a ~~control~~ system and method for controlling automatically implemented range shifting in a compound transmission having a main section shifted by a manually operated shift lever. In particular, the present invention relates to a transmission control system and method for automatic range shifting ~~which that~~ selects and initiates a range shift in response to a selected target gear ratio.

*Please amend the paragraph (section) beginning on page 1, at line 11 as shown below:*

Controller-assisted, compound, manually-shifted, mechanical transmissions are widely known in the field of heavy-duty vehicles, such as transport trucks. Typically, these transmissions include a main section shifted directly or remotely by a manual shift lever and one or more serially connected auxiliary sections. The auxiliary sections are usually shifted by a slave actuator and are either pneumatically, hydraulically, mechanically and/or electrically operated in response to manual operation of one or more switches.

*Please amend the paragraph (section) beginning on page 1, at line 18 as shown below:*

In addition to the operation of various switches, drivers of heavy-duty vehicles must be attentive to various vehicle and driving conditions to properly engage transmission shifts without causing damage to the vehicle. For example, while driving a heavy-duty vehicle, the driver must watch the vehicle speed, the road conditions, operate the shift lever, control ~~[[the]]~~ a splitter select switch to engage a particular gear ratio, and control a range select switch to toggle between at least a high range and a low range. As such, ensuring proper transmission shifts is a complicated task, especially for the inexperienced driver.

*Please amend the paragraph (section) beginning on page 2, at line 7 as shown below:*

Prior art devices with lever or switch position initiated automatic range shifting, while adding conveniences, are not totally satisfactory. Automatic range shifting is generally initiated ~~[[by]]~~ as the shift lever ~~actuating~~ actuates a fixed position sensor or switch. The lever position at which automatic range shifting is initiated is fixed. For example, as the shift lever is moved into a transition area or band from one leg of an H-shift pattern to a higher leg, it crosses a point and actuates a fixed sensor to cause automatic implementation of a range shift. ~~[[Our]]~~ One example of this range shifting method may be seen by ~~reference~~ referring to U.S. Patent No. 5,911,787, which ~~that~~ is assigned to applicant's assignee. However, this method for automatic range shifting cannot be used with a repeated H-shift pattern. In addition, prior art devices ~~[[did]]~~ do not prevent or inhibit non-synchronous shifting with a high degree of reliability. When the vehicle is operating in high range and an operator decides to shift the vehicle into low range at the wrong time, an engine overspeed condition may occur if the operator is not careful.

*Please amend the paragraph (section) beginning on page 2, at line 22 as shown below:*

In accordance with the present invention, the drawbacks of the prior art are minimized or overcome by providing an improved controller-assisted, manually-shifted, transmission system. More specifically, the transmission system may be a twelve-speed, manually-shifted, transmission that implements a repeated H-shift pattern. One improvement relates to automating range shift decisions to ~~assure~~ ensure that an appropriate range state is selected.

*Please amend the paragraph (section) beginning on page 3, at line 28 as shown below:*

According to another aspect of the present invention, a method is provided for selecting an appropriate range state from at least two possible range states in a manually shifted transmission system. A set of transmission system criteria ~~[[are]]~~ is detected including vehicle speed, a shift lever rail position, a transition to rail position, a shift knob force, a shift knob force direction, and a position of the splitter select switch. An intent to shift signal is formulated based on the shift knob force and the shift knob force direction. When an intent to shift signal is detected, a set of potential target gear ratios is determined and engine overspeed tests are executed. The set of potential target gear ratios is determined based on the shift lever rail position, the position of the splitter select switch, and the shift knob force direction. Engine overspeed tests are then executed to evaluate the set of potential target gear ratios in combination with the set of transmission system criteria in order to select one ratio from the set of potential target gear ratios. An appropriate range state is determined based on the selected target gear ratio. An automatic range shift to the determined range state based on the selected target gear ratio is then initiated.

*Please amend the paragraph (section) beginning on page 4, at line 14 as shown below:*

A manually shifted compound transmission system is also disclosed. The system generally includes a manually operated shift lever, a variety of system inputs, control logic, and a range shift mechanism. A variety of system inputs ~~[[are]]~~ is used to determine the position and to detect movement of the shift lever and to detect other engine conditions. A position sensor provides a position signal that indicates the position of the shift lever including lateral movement into the transition to high or low rail positions as well as forward or rearward movements. A force threshold detector provides a shift knob force signal indicative of directional forces applied to the shift lever by an operator. A splitter select switch is provided that toggles between high and low splitter ratios. A speed sensor is included for providing signals that indicate engine rotational speed. The control logic receives the input signals from the variety of sensors to formulate an intent to shift signal and to determine the set of potential target gear ratios. The control logic, triggered by an intent to shift signal, executes the engine

overspeed tests for the set of potential target gear ratios. The control logic also verifies at least one of the target gear ratios as being appropriate for engine conditions in accordance with the system inputs. An appropriate range state of the transmission system is automatically determined based on the selected target gear ratio. A range shift mechanism shifts the transmission into the appropriate range state as determined by the control logic.

*Please amend the paragraph (section) beginning on page 5, at line 23 as shown below:*

Preferably, in determining the appropriate range state, the transmission is shifted into low range if the shift lever position is on low rail or if the transition to low rail is detected and the shift lever position is in neutral. In addition to the aforementioned conditions, if the current range state ~~must be~~ is unknown and the engine overspeed test indicates a negative result. ~~If the conditions are not satisfied,~~ the transmission is shifted into ~~[[high]]~~ low range.

*Please amend the paragraph (section) beginning on page 6, at line 21 as shown below:*

According to another aspect of the invention, when determining the appropriate range state, if the shift lever is on high rail or if the transition to high rail is detected, and the shift position is in neutral, and~~[[,]]~~ the transmission is in high range, and the engine overspeed test indicates a negative result, then the transmission is shifted into low range.

*Please amend the paragraph (section) beginning on page 6, at line 26 as shown below:*

In accordance with another aspect of the invention, if the shift lever is on high rail or if a transition to high rail is detected and the shift position is in neutral, and the current range state ~~must be~~ is unknown and the engine overspeed test indicates a negative result, then

low range is maintained. If the aforementioned conditions are not satisfied, then the transmission is shifted into high range.

*Please amend the paragraph (section) beginning on page 7, at line 22 as shown below:*

Referring to Fig. 1, a controller-assisted compound transmission system 10 is illustrated, ~~[[that]]~~ it is particularly well suited ~~[[to]]~~ for the range shifting control system and method of the present invention.

*Please amend the paragraph (section) beginning on page 8, at line 1 as shown below:*

The transmission system 10 ~~[[is the]]~~ may be utilized in heavy-duty vehicles and includes an engine 12, typically a diesel engine, a multiple-speed compound transmission 14, and a drive axle assembly 16. The transmission 14 includes an output shaft 18 drivingly coupled to a vehicle drive shaft 20 by universal joints for driving the drive axle assembly 16.

*Please amend the paragraph (section) beginning on page 8, at line 12 as shown below:*

The engine 12 is preferably electronically controlled and ~~communicating it~~ communicates with a powertrain controller 30. The powertrain controller has control logic 32 for processing input signals 34 and sending output signals 36 to various system actuators.

*Please amend the paragraph (section) beginning on page 8, at line 26 as shown below:*

FIG. 2 illustrates an H-shift pattern 50 having two vertical legs and one connecting horizontal leg for manual shifting of the controller-assisted compound transmission

14 by the manually operated shift lever 26. Briefly, the shift lever 26 is moveable side to side along the horizontal leg, in a lateral direction, to select one of at least two rail positions. The two rail positions include at least a low rail 52 and a high rail 54. The shift lever 26 is also moveable forward and backward in a longitudinal direction to selectively engage and disengage particular gear ratios.

*Please amend the paragraph (section) beginning on page 9, at line 11 as shown below:*

A lever shift involves a change in main section ratio and is accomplished by moving the shift lever from one shift position to a different shift position. A splitter-only shift such as from a first gear ratio to a second gear ratio does not require the use of the shift lever and is accomplished automatically or in response to the operation of a splitter ratio selector switch 44.

*Please amend the paragraph (section) beginning on page 9, at line 16 as shown below:*

In the embodiment illustrated in FIG. 3, the main transmission section 22 is a 3-speed transmission with reverse. The repeat H-shift pattern has four engageable main section ratios. A low range 70 and a high range 80 H-shift pattern is shown wherein the appropriate range state is automatically determined by the control logic 32 based on system input signals 34. Each end of the rail positions represents one of the four shift lever positions. In low range 70, the main section ratios include one for reverse, one for  $\frac{1}{2}$ , one for  $\frac{3}{4}$ , and one for  $\frac{5}{6}$ . In high range 80, the main section ratios include one for reverse, one for  $\frac{7}{8}$ , one for  $\frac{9}{10}$ , and one for  $\frac{11}{12}$ . ~~[[A]]~~ The splitter ratio select switch 44, which could be manual or automatic, shifts between the gear ratios within each shift lever position.

*Please amend the paragraph (section) beginning on page 9, at line 26 as shown below:*

When an intent to shift signal is detected, the range control logic within the powertrain controller is triggered. A procedure is executed, as shown in FIG. 4, for determining the appropriate range [[state]] based on the current vehicle and transmission system inputs and more particularly, the target gear ratio.

*Please amend the paragraph (section) beginning on page 10, at line 19 as shown below:*

However, at decision block 106, if the transmission is not in low range 70 and the overspeed test for the first or second gear does not indicate a positive result, then the procedure moves to decision block 110 where it is determined whether the transmission is in high range 80 and the engine overspeed test for a first or second gear indicates a negative result. If the decision at 110 is yes, then the transmission is shifted into low range 70. If the decision at 110 is no, then the procedure moves to decision block 114 where it is determined whether the range state is unknown and the engine overspeed test for a first or second gear indicates a negative result. If decision 114 is yes, then the transmission is shifted into low range 70 at block 112, otherwise the transmission is shifted into high range 80 at block 108.